WEB-BASED SERVICES FOR BUILDING ENERGY MANAGEMENT – WEBE

Satu Paiho, Jorma Pietiläinen & Mia Ala-Juusela
VTT Building and Transport, P.O.Box 1800, FI-02044 VTT, Finland,
Email: firstname.lastname@vtt.fi

Summary

Nowadays, internet can be accessed anywhere, and www-based applications are widespread. Utilizing internet also for energy management and commissioning purposes will be a future trend. A web-based service for building energy management, called WebE, was developed at VTT. It is a modular and integrated service including several energy-related modules. This paper describes the main features of the WebE service modules. Also the system structure is briefly discussed.

Keywords: internet, buildings, energy management, commissioning, labeling.

INTRODUCTION

Nowadays, the World Wide Web (WWW) on the internet can be accessed anywhere, and web-based applications are widespread. So, it is a natural platform also for any kind of building related applications. WWW-based diagnostic tools have been developed too /1/, /3/. So, utilizing internet also for commissioning and other purposes will be a future trend. Especially, internet applications for large building stocks offer many possibilities because huge amounts of information and data can be accessed physically far away from the buildings considered.

WEBE-APPLICATION AND ITS MODULES

A web-based services tool for building energy management was developed. In addition to new development, services are based on existing tools and knowhow in VTT Building and Transport /2/, /4/, /5/, /6/. The developed application, called WebE, is a modular and integrated service (tool box) including several energy-related modules (Figure 1). The modules are:

- Building information from National Building Register
- Energy consumption estimation module called WebEtana
- Energy consumption monitoring module called WebKulu
- Fault diagnostics and commissioning of building energy systems based on variation in the estimate and real consumptions or in consumption history
- Prototype for simple and easy concept for Building Energy Certificate (eLabeling)

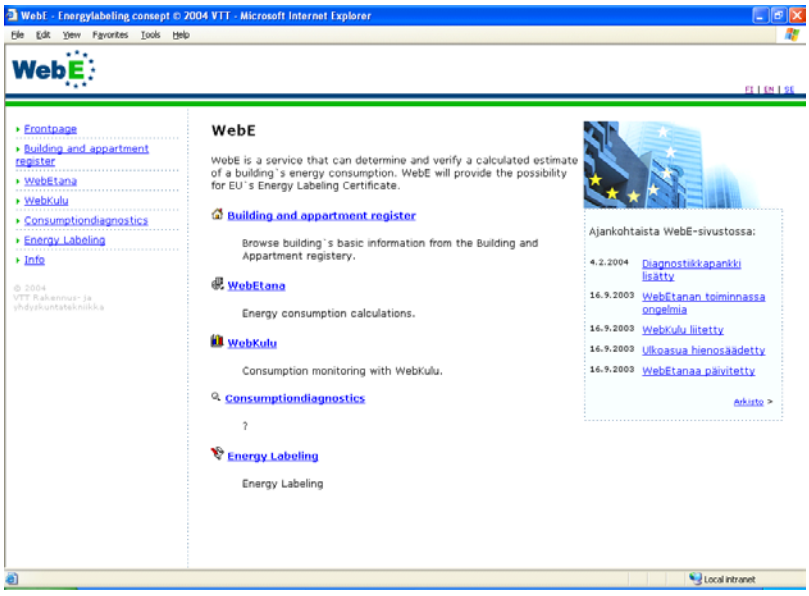

Figure 1. WebE frontpage.

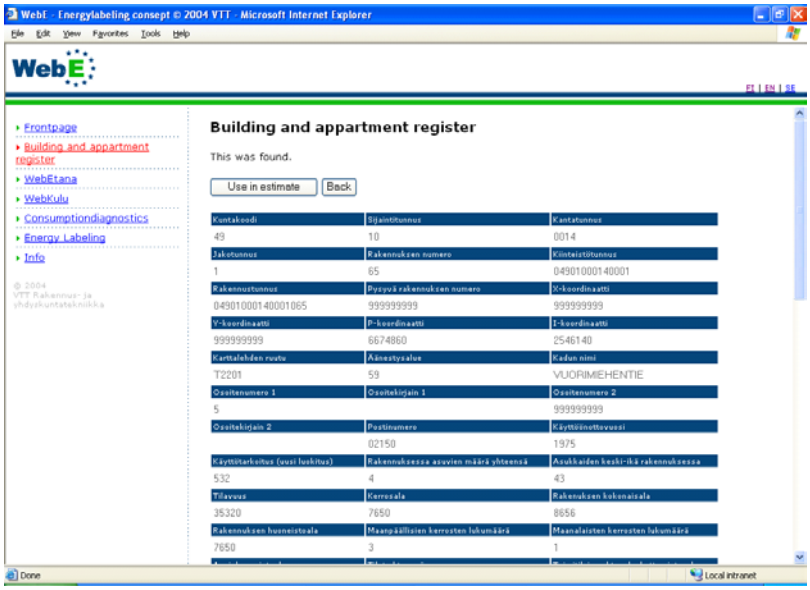

Figure 2. An example of building information.

Building Information

Building's basic properties are retrieved from the National Building Register. Information is passed to the calculation module of energy consumption estimate. Figure 2 shows an example of information read from the National Building Register. For energy calculations, most relevant data is building volume, floor area, heating method, year of construction and building type. But lot of complementing data can be found as well.

Energy consumption estimate calculation with the WebEtana module

Energy calculation with WebEtana needs very few input parameters for the first energy estimate. This data is the construction year, type of building, type of heating, total building volume, number of floors, and geographical location. More data for the calculation is generated from the system's default value database according to the first given data. It is possible to adjust and define the calculation parameters if needed. The results can be displayed in charts etc. (Figure 3). The results can be exported to an energy consumption monitoring module too. WebEtana is easy to use, simple, fast, and accurate enough for many purposes.

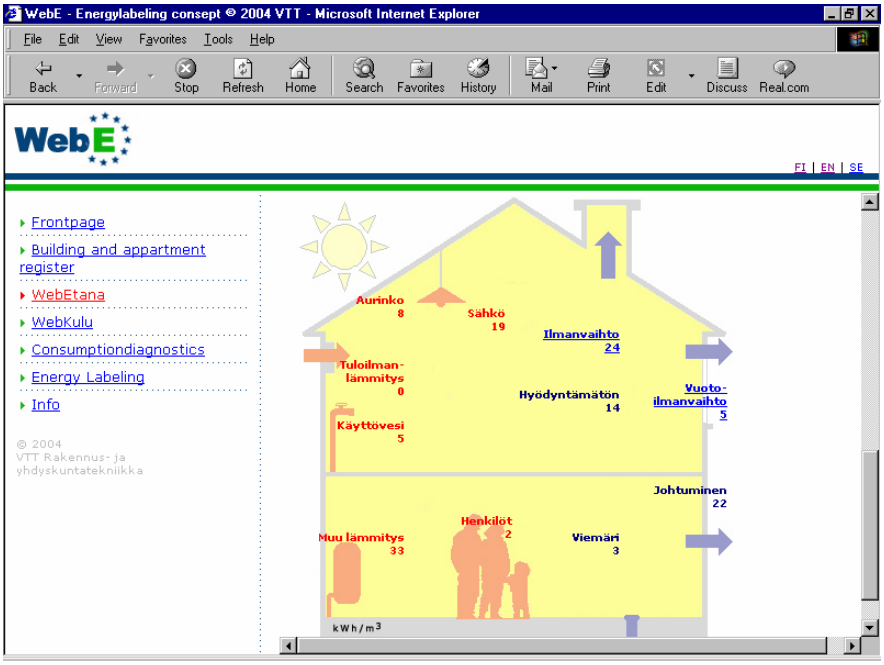

Figure 3. An example of WebEtana´s output.

Energy consumption monitoring with the WebKulu module

WebKulu is a web-version of the Kulu software, which is used for monitoring heating energy, electricity and water consumptions of buildings. WebKulu includes multiple features to input meter readings or consumption, and versatile tools to report, analyse and benchmark consumptions (Figure 4).

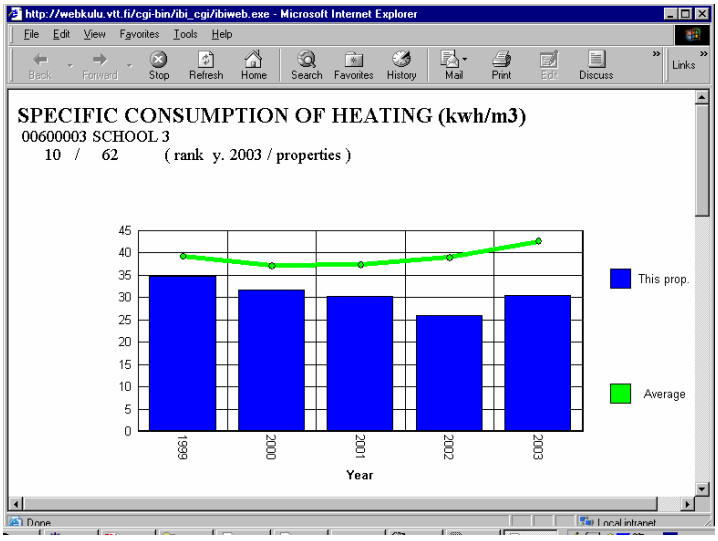

Figure 4. An example of WebKulu consumption report.

Fault diagnostics and commissioning

Fault diagnostics can be based on variation reports in real consumption history, and on variation reports with the estimated and the real consumptions. The module includes basic instructions for diagnostics, and provides the most likely reasons for variations in consumptions.

In Figure 5, the principle of the FDD and continuous commissioning system structure is shown. First possible causes of malfunctioning can be obtained with a very limited number of data and information. The accuracy of the analysis is improved when the available data and information from the systems increases. The system gives continuos feedback to the user.

In Figure 6, there is a flow chart describing how the FDD/commissioning module works. The presented windows, options and solutions are based on the type of considered cases. Different kinds of fault and malfunctioning causes are given for different buildings based on heating systems, deviation types and selections of the user.

The target users of the tool are building owners, building operators, operation and maintenance personnel, and, if existing, commissioning agents. The target phase is the operation of buildings. The target building can be any building but the first version deals with offices and residential buildings. The tool is meant for continuos commissioning.

The tool is mainly for BEMS assisted performance testing and partly for functional testing. Depending on the data and information available, building level, subsystem level or component level systems can be regarded. Sampling and data analysis are the main methods used.

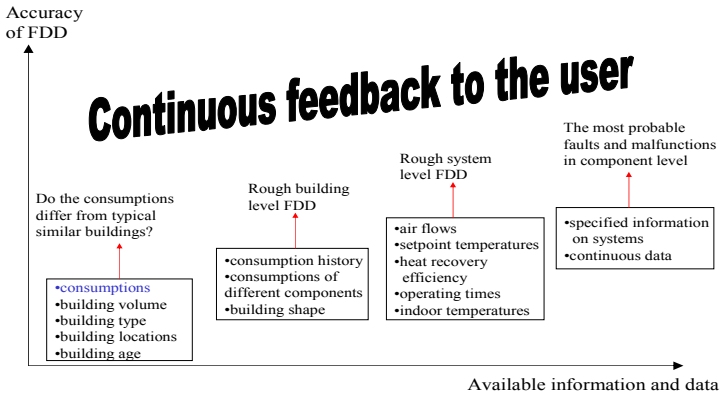

Figure 5. The principle of the FDD system structure.

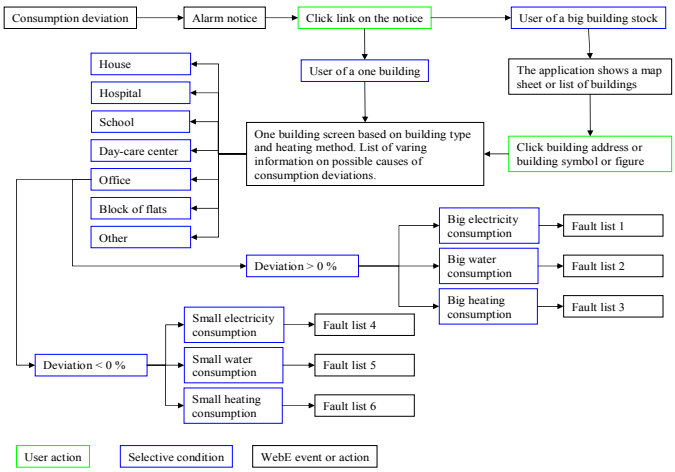

Figure 6. A flow chart of the FDD/commissioning module.

Energy Certificate for buildings

In the European Union an Energy Certificate becomes mandatory for most of the buildings by the end of 2009 when a building is taken into use, sold or rented. eLabeling offers an easy possibility to implement a certificate required by he new European Energy Performance Directive. The WebE service tool can be used for testing of an Energy Certificate, where the calculated and the monitored energy consumption has been taken into account. In the screenshot, the energy efficiency of a building is calculated to be in class C and monitored to be in class D (Figure 7).

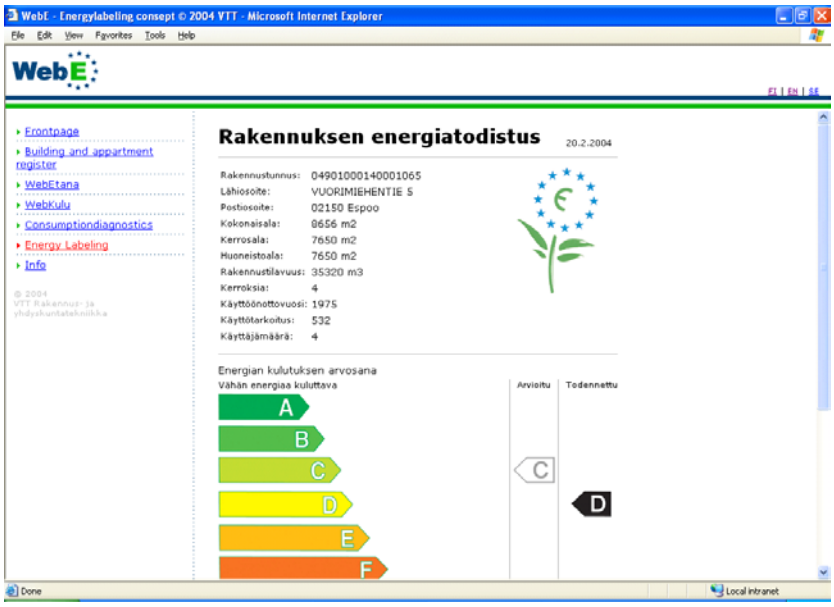

Figure 7. An example of a possible energy certificate.

WEBE - SYSTEM ARCHITECTURE

The WebE service tool (Figure 8) is an ASP application implemented in a Ms IIS 5.0 Web server. It has its own MsAccess database where data can be read and write through an ADO interface. The WebE application understands ASP-requests from a standard web-browser (Ms IE 6.0) and writes output in a HTML format.

The WebEtana module is an ActiveX serverside component programmed by Visual Basic. WebEtana database is implemented in MsAccess which can be read and write through an ODBC interface.

The WebKulu module is a WebFocus application implemented in a WebFocus server. It also has its own database implemented in WebFocus where data can be read and write through a Focus interface using SQL-requests. WebE application sends WebKulu cgi-requests and gets data in html format.

WebFocus can read consumption data from a building automation system (BAS) as well. In future it will be also possible to connect building automation systems to the WebE application through an open protocol, such as Lon.

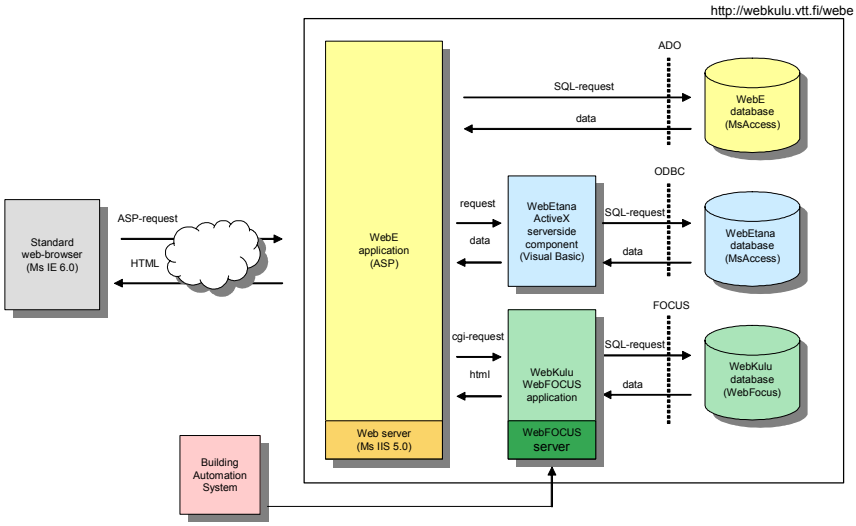

Figure 8. WebE - system modules.

DISCUSSION

In internet a portal supporting three languages (Finnish, Swedish and English) was developed, where all aspects related to building energy management can be utilized efficiently. Both large building stocks and single buildings can be observed. The first implementation supports office buildings and municipal buildings. After commercialization, the services provide building owners, building operators, maintenance personnel, service companies, and commissioning agents possibilities to observe and utilize all energy related building information and data from any location by using a standard web-browser.

Typical applications on the market are only valid for some single purpose. The strength of WebE is that it connects energy consumption data (both estimated and actual) to building, system and component level diagnostics. Through the same service it is also possible to show Building Energy Certificates which will become mandatory for all buildings in the future. At the moment the implementation of certificates is open but WebE offers a ready platform to test an ebusiness-type concept for labeling and certification.

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